

Earth's Atmosphere and Weather

6-4 The student will demonstrate an understanding of the relationship between Earth's atmospheric properties and processes and its weather and climate. (Earth Science)

6.4.2 Summarize the interrelationships among the dynamic processes of the water cycle (including precipitation, evaporation, transpiration, condensation, surface-water flow, and groundwater flow).

Taxonomy level: 2.4-B Understand Conceptual Knowledge

Previous/Future knowledge: In 4th grade, students summarized the processes of the water cycle (including evaporation, condensation, precipitation, and runoff) (4-4.1) and classified clouds according to their three basic types (4-4.2). In 5th grade (5-4.2), students compared the physical properties of the states of matter. The addition of transpiration and the two areas of run-off are new information. In 7th grade (7-4.5), students will study groundwater zones and surface water drainage basins.

It is essential for students to know that water is always moving between the atmosphere (troposphere) and surface of Earth. Each components of the *water cycle* process has certain conditions under which each form of precipitation develops:

Precipitation

- After condensation occurs (forming clouds), water droplets fall in various forms of *precipitation* – rain, snow, freezing rain, sleet, or hail, depending upon weather conditions.
- Temperature variations within clouds and/or within the region between the cloud and Earth allows for the various forms of precipitation.

Evaporation/Transpiration

- Water enters the atmosphere as water vapor through evaporation and transpiration, plants releasing water vapor.

Condensation

- *Condensation* happens in the atmosphere as water vapor changes to water droplets.
- Clouds form as a result of condensation.
- *Dew* forms when water vapor condenses directly onto a surface;
- *Frost* forms when water vapor changes from gas directly to ice crystals on a surface when the temperature at which condensing would take place is at the freezing point or below.

Run-off

- If precipitation falls on land surfaces, it always attempts to move back toward sea level as *surface-water flow* or *groundwater flow*.
- The surface that receives the precipitation determines its flow back towards sea level. Examples are:
 - Water will remain on the surface when the surface is not porous or the precipitation is falling too fast for the water to sink into the ground.
 - Water will sink into the ground when the surface is porous and there is lots of space in the soil to hold the water.

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It is not essential for students to know what happens to the individual water particles as they change from one state of matter to another.

Assessment Guidelines:

The objective of this indicator is to *summarize* the interrelationships among the processes of the water cycle; therefore, the primary focus of assessment should be to generalize major points about the parts of the water cycle (including precipitation, evaporation, transpiration, condensation, surface-water flow, and groundwater flow). However, appropriate assessments should also require students to *identify* parts of the water cycle; *compare* one part of the water cycle with another; or *illustrate* parts of the water cycle using words, drawings, diagrams, or symbols.